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Impact of Climate Change on U.S. Military Operations in the Western Pacific

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Abstract: Climate change will dramatically affect many nations in the Asia-Pacific region. We assess that the region's climate-related challenges 30 years from now will be similar to those of today—storms, flooding, drought, agricultural stress—but with greater average frequency and intensity. The security lines of operation most likely to be affected are humanitarian assistance and disaster relief and theater security cooperation. The authors find that the U.S. military is well equipped for these operations, even if they occur with growing frequency and complexity. This article is based on a study CNA performed in 2015 for the Office of the Secretary of Defense.

Keywords: climate change, Asia-Pacific, humanitarian assistance, disaster relief, theater security cooperation, military outreach, USPACOM, Pacific Pathways, ASEAN, migration

In future decades, climate change will reduce freshwater, dry soils, melt glaciers and ice shelves, and intensify flooding, droughts, and storms in many regions of the world. Supplies of water, food, and energy will be affected, causing societal stress and instability. Countries where governments already struggle to provide basic services and protections to their populations will be sorely challenged to respond. Mass protests, rising crime rates, migration, and

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insurgency will be increasingly likely and widespread. In areas where poor governance overlaps with long-standing tensions, these additional stressors will raise the risks of political instability and violent conflict.¹ In its 2014 *Quadrennial Defense Review*, the U.S. Department of Defense (DOD) stated that the effects of climate change act as “threat multipliers that will aggravate stressors abroad such as poverty, environmental degradation, political instability, and social tensions,” and that climate change “may increase the frequency, scale, and complexity of future missions.”²

The full range of these impacts described by the DOD is expected in the Asia-Pacific region, where they will affect a population of more than 3 billion people. Since the region is also a dynamic and growing theater for U.S. military operations, consideration of how these climate change-driven impacts may affect those operations in the Asia-Pacific yields lessons that apply around the globe. This article is an effort to advance our understanding of those impacts, their likely effects during the next 30 years, and the implications for U.S. military policy, force structure, operations, and international cooperation in the Asia-Pacific theater. Understanding the ways in which climate change is likely to affect the demand for security assistance and operations in the Asia-Pacific will help the DOD predict and plan for contingencies and conflicts as well as train and equip U.S. and partner nation forces for realistic future scenarios of crisis and turmoil. Adapting to, planning for, and taking measures to prevent the worst climate change impacts as a community of partner nations can also be an area of collective risk management and cooperative response to shared security threats.

We will argue that, in general, DOD capabilities and assets in the Asia-Pacific are likely to be sufficient to support emergency response missions, even as these increase incrementally in frequency and intensity in the decades to come. Moreover, the DOD and its regional partners should incorporate rising likelihoods that sequences and overlap of such missions might simultaneously occur around the world, as well as the risks of missions in the Asia-Pacific requiring humanitarian assistance operations in the midst of social tensions and conflict. Later in the essay, we will discuss the rising importance for U.S. regional security interests of emerging powers as well as traditional allies, as we foresee that U.S. forces and assets will increasingly play support roles within regional and international coalitions. The degree to which the United States and China can cooperate on issues of regional environmental protection, adaptation to climate change effects, and humanitarian assistance will determine in large part the contours of the region’s security cooperation in this area.

Climate Change Effects in the Asia-Pacific

While some consequences of climate change will result in political or financial responses, the focus of our investigation was the effects that are most likely

to create demands or requirements for response that potentially include security forces. Putting aside more extreme scenarios where military capabilities are used to help mitigate climate effects, such as launching substances into the atmosphere or oceans, we are concerned mostly with the effects to human systems and the resulting societal responses to those effects.

Expected Physical Changes

The fifth assessment report of the United Nation's Intergovernmental Panel on Climate Change (IPCC) documents likely climate change events that will have an impact on the Asia-Pacific region. Storm damage, drought, flood damage, and water and food scarcity are anticipated outcomes for countries in the Asia-Pacific due to climate change.³ Although, over the long run, sea-level rise poses a staggering threat to coastal populations and infrastructure across the Asia-Pacific, we exclude it from our analysis because its impacts are not likely to be dramatic during the 30-year time horizon. Because of the larger global changes, nations in the Asia-Pacific will see, as other nations have, extreme weather events. Storms will, therefore, cause more damage in the future. The current state of science is unclear about the future frequency of typhoons and cyclones, and scientists are cautious to predict their numbers. The intensity of these storms, however, is expected to increase with warmer sea-surface temperatures.⁴ Flooding, already a relatively common problem across the Asia-Pacific, is expected to grow more intense and frequent during the next 30 years.⁵ Several factors will contribute to the intensity and timing of floods, including more volatile precipitation patterns and glacial melt, which may increase the variability of flow rates in many of the region's major river systems.

In contrast to the effects of water damage, rising global average temperatures will almost certainly produce increasingly frequent and more intense episodes of drought and the concomitant problems of food and water scarcity. The likelihood of future droughts is believed to be highest in regions that are already prone to such cycles or conditions. In the Asia-Pacific region, this includes India, Bangladesh, Nepal, Bhutan, Cambodia, and Laos. Prolonged drought can severely affect agriculture and food production, energy production, and public health.⁶ Due to population growth and economic expansion, demands for food, water, and energy in the Asia-Pacific are expected to increase by 35, 40, and 50 percent, respectively, before 2030.⁷ Climate change, along with poor conservation measures, is expected to reduce freshwater reserves and agricultural production while also affecting regional fish stocks.

Asia-Pacific Country Vulnerabilities to Climate Change Effects

Analyses of climate change-related trends indicate that several areas of the Asia-Pacific are likely to be more significantly affected than others. The impli-

cations for human security will largely be a function of more than just geography, climate, and weather but also of the capacities of local human systems (e.g., industries, markets, and governments) and communities to respond to those effects. We have identified countries that are most vulnerable to climate effects by synthesizing the results of two widely referenced models: the Global Adaptation Index (GAIN) and the Climate Change Vulnerability Index (CCVI). Moreover, we have provided a hierarchy of their relative susceptibility to the change in climate during the next 30 years.⁸

Most Vulnerable: Bangladesh, Cambodia, Nepal, Myanmar, Philippines, and Papua New Guinea

Each of these countries faces several likely dangers, including flooding, water scarcity, and agricultural stress, and are in this category because of these effects but also because they have large, vulnerable populations with relatively little resilience. They are highly likely to experience climate-related crises affecting millions of people in countries where governance is relatively weak and inter-ethnic and nationalist tensions exist. They will require significant assistance from the international community.

Highly Vulnerable: India, Laos, Vietnam, and North Korea

These countries are expected to face several climate-related risks but not to the extent or with such low resiliency as the most vulnerable group. Still, they will likely require assistance to address their difficulties.

Vulnerable: Indonesia, Thailand, China, and Mongolia

The remaining nations are estimated to face less severe future environmental threats or to have greater national resilience to prepare them to address the effects of climate change. Though vulnerable, the core economic and political structures of these nations are not likely to be at risk from climate change-related effects.

Societal Responses

Resource Scarcity and Competition

Several case studies suggest a link between resource scarcity and environmental stress and human conflict in such places as Somalia and Syria. Some recent studies have found correlations between higher temperatures and violence across various settings and periods of time, although there is not yet a general consensus.⁹

In the Asia-Pacific, the effects of climate change, poor conservation, and ineffectual regulation of natural resources are expected to reduce freshwater resources, undermine agricultural production, and cause regional fish stocks to

dwindle and shift.¹⁰ Many governments in the Asia-Pacific are concerned with protecting and conserving their native resources as well as finding additional resources, but in many cases, natural resource pools cross national boundaries so that unequal national efforts to conserve resources undermine success and can generate international tensions. Rising levels of resource competition and *tragedy of the commons* failings can drive overutilization and nationalist or ethnic factionalism.

In recent years, regional resource contention—for example, maritime boundary claims, fishing, and oil exploration rights—has intensified in the South China Sea. Strong nationalistic language and symbolism are used in arguments about territorial claims and the use or management of transnational resources. Although regional economic integration has improved the lives of millions across the Asia-Pacific and cooperation, not conflict, has generally prevailed among the nations in the region, these increasingly contentious issues portend a possible future region where droughts, floods, and food and water insecurity combined with fierce nationalist antipathies could lead to instability and conflict.

Mass Migration

Human immigration (across national borders) and emigration (defined here as immigration within national borders) has been a common, recurring feature of the Asia-Pacific. Populations driven by misery and insecurity in times of natural disasters, war, or political violence flee to cities and across borders. Rarely have these migrations resulted in conflict. Nevertheless, migrants are often poorly skilled and ill-equipped to succeed in their new communities, and their frustration can drive them to engage in crime and violent acts. In some cases, migration across national or ethnic borders that pits one nationality or religious group against another, as seen in Bangladesh and India between Muslims and Hindus, has led to religious persecution and violence.

The effects of climate change could trigger migratory waves in the future, raising the risk of destabilization and conflict. Some regions of the Asia-Pacific, especially along the major river systems and deltas in South and Southeast Asia, are increasingly prone to floods and cyclones—events that already drive episodes of migration.¹¹ When states are already engaged in tense situations, such as the border dispute over Kashmir or the Arunachal Pradesh region between China and India, additional stressors such as rapid migration could cause a rapid escalation in tensions, especially considering the demographic changes. *Youth bulges* will be common across the Asia-Pacific in the coming decades. Researchers have identified this demographic condition whereby reduced infant mortality rates coincide with high fertility rates to produce higher than usual numbers of young adults. Youth bulges could add to the volume of pop-

ulation that is frustrated and anxious to flee when climate change-related impacts are felt.

Lastly, urbanization, which is projected to increase in the coming decades, already creates serious tensions between city dwellers and rural migrants seeking work. Much of this migration currently occurs to support skilled and unskilled labor needs, but cities often cannot keep up with the pace of migration, which would be especially true considering future youth bulges. Misery, frustration, and outrage in densely concentrated, and often ethnically defined, areas of cities pose serious risks for instability.

State Policies or Actions

As such effects as water scarcity, agricultural failure, and storms intensify, populations may demand government action. Indeed, climate change-related problems are already widely recognized in the region. Some governments, China being a prominent example, are taking measures to respond; for example, building dams to manage water flow and generate energy as well as regulating industry and development. Other governments are doing relatively little. When state actions—or inaction—create unequal costs and benefits for different groups (e.g., rural vs. urban residents or lower vs. higher income populations), they can create or exacerbate political and societal divisions. State policies and actions, and their associated risks, take various forms.¹²

In cases where resource pools cross national boundaries, government actions can create international tensions. The likelihood of conflict increases when countries are already engaged in disputes. One of the primary concerns in the Asia-Pacific region relates to water. Several river basins traverse the political boundaries of multiple countries (e.g., Indus, Brahmaputra, Meghna, Ganges). State policies in upstream countries often affect countries downstream, which can create tension. This tension has been demonstrated on the Brahmaputra River, which is shared by Bangladesh, China, and India. China benefits from its upstream location and has established numerous dams and river diversions. India and Bangladesh have complained about China's unwillingness to discuss planned projects; nonetheless, they too have built or are building dams and other projects with questionable long-term effects.¹³

Over the coming decades, these decisions and actions, or lack thereof, will take place under exceptionally dynamic political conditions. Several Asia-Pacific countries are poised to democratize, which has historically been a highly unstable process. Climate change-related effects are likely to present another set of complex challenges—along with economic inequality, ethnic and regional divisions, and environmental degradation—which will complicate and raise the risks involved in those transition processes.¹⁴

As the effects of climate change grow more severe, public and political in-

terest in climate modification or geoengineering techniques will likely increase. Such efforts include increasing the reflective capacity of the Earth's stratosphere by adding sulfur particles and cloud seeding for rainfall, which appear to be technically feasible and relatively inexpensive options.¹⁵ Because these efforts are cheap and easy to implement compared with climate change adaptation and mitigation strategies, individual nations, or even individual people, could deploy these methods unilaterally. This may incite tensions if nations that do not consent to atmospheric modifications are adversely affected by unilateral geoengineering.¹⁶

Interrelated and Simultaneous Effects

When considering possible future effects from climate change, it is important to understand that those effects are not individual in nature, nor are they limited to one locality or region. They are likely to be interrelated and to occur in several regions simultaneously or in close sequence. This likelihood raises the risk to DOD and regional partner forces, which must contemplate and plan for requirements to respond to multiple crises at once or in close succession and to crises with several dimensions (e.g., protests or intergroup violence in the context of regional droughts and food shortages). It is also likely that the DOD will have to support crisis-response operations, including potentially complex ones, in different regions of the world and potentially on U.S. territory at the same time as operating in the Asia-Pacific.

Geopolitical Implications of Changes in the Arctic

One example of regional spillover involves the Arctic. The U.S. Navy's 2014 *Arctic Roadmap* estimates that by 2025 the Northern Sea Route through Russian Arctic waters will be reliably open for maritime traffic for several weeks annually.¹⁷ By 2045, other routes are likely to be open to traffic as well and for longer periods of time, which will make the Bering Strait a busy waterway of strategic importance and could affect the relevance of other major waterways in the region including the Malacca Strait. As a result, the security and safety requirements of U.S. and partner nation forces may greatly increase in the northern Pacific Ocean. This emergence of what amounts to a new strategic theater of operations will bear implications for force structure, especially a demand for new infrastructure in the area and additional ice-capable assets and relationships across the whole Asia-Pacific region.

Summary of Regional Vulnerability

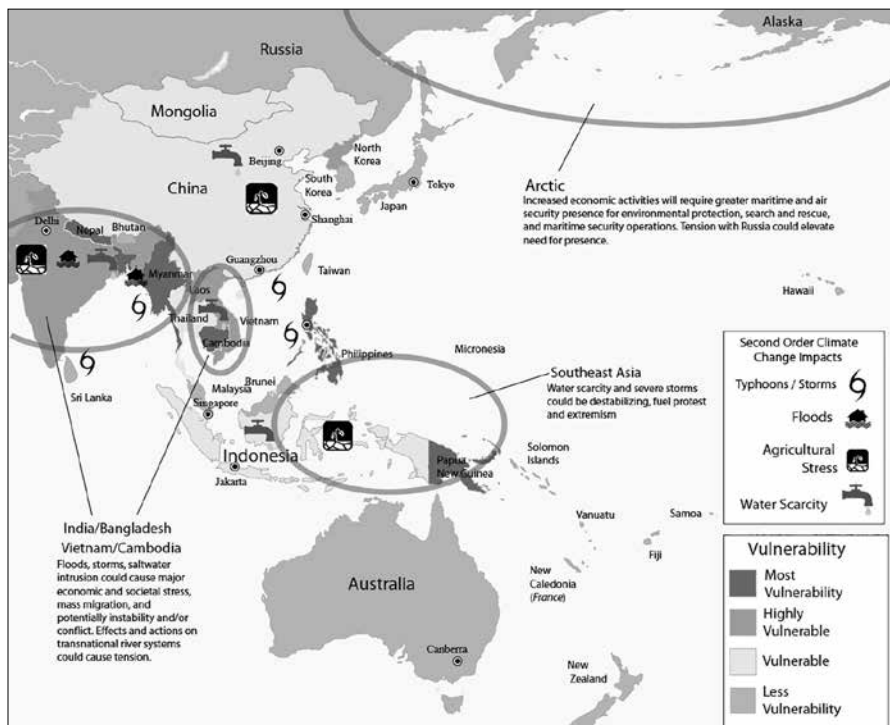
During the next 30 years, regional climate models indicate that several Asia-Pacific countries will suffer from a combination of the risks and vulnerabilities described above. Figure 1 shows the countries estimated to be the most vul-

nerable, and least resilient, to climate change-related effects. Three “hot spot” regions, where current patterns and trends suggest that environmental, demographic, and political risks converge, are also indicated. These regions are particularly prone to future instability and crisis as the effects of climate change intensify.

Current Forces and Missions

Before considering the future effects of climate-related factors on U.S. military operations and force structure in the Asia-Pacific, we must first describe how natural disasters and related crises have affected U.S. military operations there in recent years.¹⁸ Between 1970 and 2003, more than two-thirds of the contingency-response incidents in the Pacific involved humanitarian assistance and disaster relief (HADR) conducted by the U.S. Pacific Command (USPACOM), which is the DOD joint combatant command responsible for all military operations in the theater. The next largest categories of operations were shows of force and preparations and executions of noncombatant extraction operations. Figure 2 depicts the level of effort that the U.S. military put into each response. Two metrics that reflect the level of effort are the duration

Figure 1. Regional vulnerability to the effects of climate change



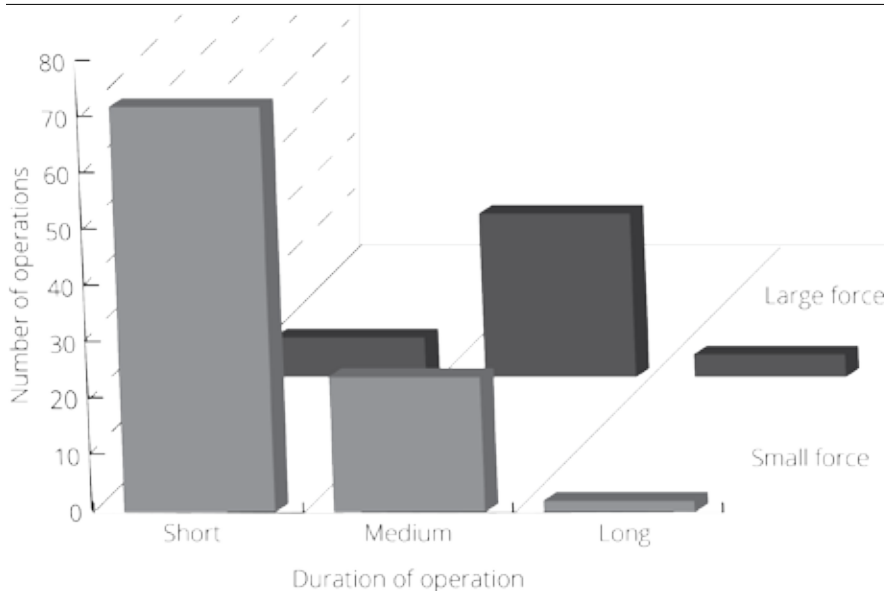
Adapted from Ralph Espach et al., Climate Change and the Future of U.S. Military Operations and Security Cooperation in the Asia Pacific, by MCU.

of the response and the scale of the response (i.e., the number of assets and troops involved). For duration, we define short as one week or less, medium as one week to 90 days, and long as more than 90 days. For scale, we define small as follows: for the Air Force, fewer than 7 aircraft; for the Navy, 1–3 ships or a Seabee detachment; for the Marines, a squadron or company; for the Army, a humanitarian assistance survey team or 350 troops. We define large scale as: for the Air Force, more than 20 aircraft; for the Navy, more than 30 ships; for the Marines, a Marine expeditionary force (MEF) of 47,000 sailors and Marines or Marine expeditionary brigade (MEB) of 4,000–16,000 sailors and Marines; for the Army, a division of 10,000–15,000 soldiers; or a combination of small and medium assets.

Most of the events were short, generally lasting only a day or two. Political events caused the responses that took more than 90 days. The others were a relatively proportionate mix of political and natural events. The most common responses at all levels of scale and duration were for tropical storms and floods.

Figure 3 depicts the frequency of response of each Service, helping to identify the specific Services and implied capabilities that are most relevant to Asia-Pacific operations. Air Force assets have been in highest demand, although only for short spurts, generally to deliver supplies via airlift to affected regions. Furthermore, the Air Force has responded more than the other Services have. Only 25 percent of Air Force events were part of joint operations, whereas the

Figure 2. Response by level of effort



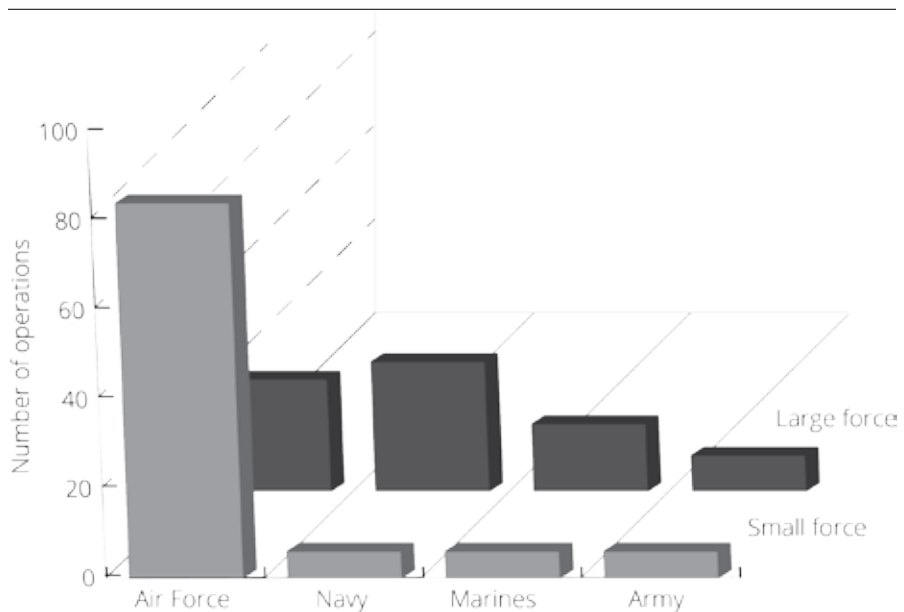
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other Services were involved in joint operations 75–90 percent of the time. Joint responses tend to correspond to higher levels of effort. The Navy and Marine Corps have usually been involved in more sustained surges, and their operations have typically involved larger levels of effort. The Army has been least in demand, participating in only about 10 percent of events, apparently because that Service has generally been less suited to the quick-response actions that disasters require.

It is important to note that the State Department actually manages U.S. national foreign disaster response efforts. Specifically, within the State Department, the U.S. Agency for International Development (USAID) Office of U.S. Foreign Disaster Assistance (OFDA) is in charge of coordinating all government and military disaster assistance efforts. Thus, in the case of HADR operations, the U.S. military supports other government agencies instead of the afflicted nations directly and participates in the relief effort only at the formal request of the host nation. Furthermore, the U.S. military does not respond to all natural disasters. In fact, in recent history, it has responded to only about 10 percent of them.¹⁹

Information about USPACOM's current and recent operations and capabilities for theater security cooperation (TSC) and HADR efforts provides useful background for our discussion of future challenges resulting from climate

Figure 3. Level of effort across Services



Adapted from Ralph Espach et al., Climate Change and the Future of U.S. Military Operations and Security Cooperation in the Asia Pacific, by MCUP.

change. There are four key points worth considering. First, climate- and weather-related issues already affect USPACOM operations on a regular basis, and USPACOM's TSC and HADR missions most directly address these issues. Second, TSC activities are linked to strategic objectives beyond helping partners and the DOD improve resilience to environmental change or crises. Nevertheless, there have been opportunities to apply TSC efforts to address environmental concerns. Third, trends in OFDA's declaration of foreign emergencies and its requests for military support indicate that global and regional stability and strategic interests strongly influence our national security leadership's willingness to involve the DOD in disaster response efforts. Disaster response is a fundamentally interagency process and the DOD is only occasionally called upon to help. Fourth, the Air Force is the U.S. Armed Service most frequently deployed for HADR; it delivers supplies and assistance on a short-term basis. Longer-term operations sometimes involve the U.S. Navy and Marines, but these have been relatively few in recent decades. The Army has been the least called-upon Service to support these operations.

Potential Changes to Forces and Missions

In 2007, the CNA Military Advisory Board released a report titled *National Security and the Threat of Climate Change*, which argued that climate change is a threat multiplier for instability in some of the most volatile regions of the world, exacerbating risks to U.S. national and regional security interests. The authors of the report argued that climate change may increase the chances of conflict and affect weapons systems, platforms, bases, and military operations.²⁰ After publication of the CNA report, numerous authors and organizations as well as government, intelligence, and military offices have written similar assessments demonstrating the need to consider these issues. The inclusion of climate change into the 2008 *Quadrennial Defense Review*, for example, was a direct outgrowth of the CNA report. We organize the future challenges from climate change for military operations into three categories: operations, capabilities, and posture. Operations are the activities that the DOD and armed forces conduct to accomplish their missions. Capabilities are the resources and assets required to conduct those operations. Posture refers to the force structure, geographic positioning, and international access and agreements relevant to conducting those operations.

Operations

The DOD's official missions in the Asia-Pacific are to deter aggression, advance regional security cooperation, promote peaceful regional development, and if necessary, respond to crises as well as win the nation's wars. The military's capabilities for rapid deployment, worldwide reach, heavy lift, and command and

control, however, provide significant capacity for the support of humanitarian assistance missions. The issues raised earlier in this article do not portend dramatic changes in the types of missions. The scenarios envisioned fall within the scope of crisis-response activities that the U.S. military has conducted over the years. We do not anticipate any change to these missions as a result of the effects of climate change, although the effects may pose various challenges to regional development and stability. Furthermore, there may be changes in the frequency, duration, and severity of the scenarios that could cause changes in the requirements for military forces.

Over the next decades, the DOD missions most likely to be affected by climate change in the Asia-Pacific are TSC and HADR. The military could be required, however, to conduct stability operations related, at least in part, to climate and weather effects. In addition, though only indirectly related to the Asia-Pacific region, USPACOM may be asked to provide greater presence and support further north because of rising demands for greater presence in the Arctic.

USPACOM's concept plan for foreign humanitarian assistance lists the potential types of operations the military might undertake: preventive medical assistance, security for warehouses and distribution points, improvement of road networks and infrastructure, and maintaining public order and security, including the demobilization of belligerents. The types of operations include establishing and managing aerial and sea ports of debarkation, strategic air and sealifts, aid delivery, water purification, and mortuary affairs. The military provides security as needed, but for the most part, military HADR operations focus on providing logistical support.

Capabilities

Understanding the impact of climate change and how that will change the demands on the U.S. military is important because, historically, the military has not sized or structured its forces to meet HADR requirements. Rather, force structure is based on the requirements to fight and win major combat operations. Moreover, a more general requirement is to be ready to respond to events as they arise. We do not expect significant changes to U.S. military capabilities in the future in response to demands for TSC or HADR operations. Indeed, TSC and HADR are missions USPACOM conducts regularly with capabilities and assets primarily assigned to other key missions.

Primary relief needs for HADR include fresh and clean water, food, sanitary facilities, and shelter. In most cases, the earlier the relief is provided, the better the effect. Highly desired capabilities include both strategic airlift to stage supplies in-theater and helicopters to move the supplies locally, runway repair to facilitate the arrival of supplies, and command and control systems for

communications and maintaining situational awareness. Each Service provides a set of appropriate capabilities, with significant overlap among them. Moreover, each also has particular strengths that are relevant in different ways to the HADR requirements.

The competencies and global reach of Air Force platforms is critical for meeting those requirements. Strategic lift is a fungible and quickly redeployable asset. During international disasters, the Air Force is the only military force that has the airlift and air refueling capability to provide immediate relief supplies and personnel in response to global emergencies. In addition, the Air Force is developing new rapid runway repair technologies, which could also support expeditionary operations in devastated regions.

The other Service branches also provide unique capabilities; for example, Navy and Marine Corps platforms provide support from the sea. This capability provides two advantages. First, it reduces the military footprint on a foreign nation's sovereign territory, thereby facilitating the delivery of supplies while minimizing concerns among the local population and host nation government about military aggression or dual-purpose activities. Second, it reduces the need of the U.S. military for force protection ashore because military personnel delivering relief supplies spend less time on the ground. Having a small footprint ashore was important during the tsunami relief operation Operation Unified Assistance in the Aceh Province of Indonesia where HADR took place during a civil war in 2004.²¹

Amphibious ships and helicopters are key assets. In some cases, tactical lift (i.e., local movement of supplies to those in need) provided by naval forces is more important than strategic airlift—the wholesale movement of supplies from the United States or other contributors to the affected region. For example, in Operation Sea Angel, instigated after a cyclone hit Bangladesh in 1991, by the time the U.S. military had entered the picture, the greatest need was one of providing transportation capabilities to deliver supplies. The Bangladeshi government and nongovernmental organizations (NGOs) already had enough relief supplies, but they had no way of transporting them to the affected populations, especially in remote populations. As a result, the U.S. military's transportation capabilities were an important asset to the international effort, and the military focused its operations on providing transportation.

Other pertinent naval capabilities and strengths include

- employing Seabees who can provide expeditionary engineering capabilities to prepare sites for airfields and camps and to restore services;
- assisting with the organic production and distribution of potable water, often a critical relief need; and

- preparing hydrographic surveys, which can be critical for post-event analysis.²²

While the Navy can provide services needed early on during disaster events, the Army is better positioned for engaging situations in a different manner. Although less rapid and mobile, the sustainability of Army forces makes them well suited to longer-term, humanitarian assistance efforts and pandemics. These could include making improvements to road networks and infrastructure, providing medical training and treatment centers, and helping to maintain public order and security as the host-nation government pulls through the difficult situation. That said, the key contribution of the Army is to provide security operations, including security for warehouses and distribution points, protection of key assets (e.g., communications sites, power plants, and other utilities), and force protection. The Army is not a quick-reaction, expeditionary force of the type usually needed to support disaster relief operations, but the Army has been developing what it calls Pacific Pathways to improve flexibility.²³

Given that long-range cargo aircraft are fungible and that supply missions are of short duration, during the next several decades the Air Force should be able to orchestrate the available fleet to meet even unprecedented levels of requirements. The same could be said about maritime platforms; USPACOM itself has numerous suitable vessels in various configurations. The availability of partner nations' assets would offer further options and flexibility. It should be noted, however, that a disproportionate share of the anticipated effects of climate change in the Asia-Pacific will affect coastal areas, which suggests a rise in demand for capabilities and assets, such as shallow-draft vessels, small-deck amphibious ships, littoral combat ships, and other vessels that support helicopter operations.

Despite our overall assessment that USPACOM's expected capabilities across the Services for the coming decades should be sufficient for its growing HADR requirements, it is worthwhile to consider the possibility that natural, and human-influenced, disasters may occur more frequently, for longer periods of time, or under more stressful conditions. In 2007, the DOD was tasked to respond to four HADR operations—an 8.0 earthquake and tsunami in Peru, Hurricane Felix in Nicaragua, flooding in the Dominican Republic, and Cyclone Sidr in Bangladesh—in a period of four months. The U.S. military was capable of providing support in response to each of these disasters. Still, increasing numbers of operations in a short period of time may become a “new normal,” potentially within a less stable international context.

Given the seriousness of slow-onset disasters, such as drought, sea-level rise, and their concomitant effects, we expect rising demand in the region for

TSC activities related to those challenges. The following types of capabilities and assets will likely be useful for responding to this demand:

- medical subject-matter experts who can assist partner nations in addressing the wider spread of vector-borne diseases
- civil engineers who can provide infrastructure and logistics support especially in isolated areas
- legal subject-matter experts who can define and align regional legal standards to allow multinational groups of experts to work together
- military platforms and systems that can support strategic air-lift and sealift for DOD and partner nations

We recommend that military acquisition and planning protect the above capabilities and areas of expertise so that sufficient capacity will persist if the demand rises.

Responses to slow-onset crises usually involve the military in the later stages, when states need assistance to quell violence, restore state control, and help with humanitarian operations. In a future where slow-onset crises will afflict more than one country at a time and where governments are at a loss to address fundamental causes (short of climate modification measures), however, scenarios could involve persistent involvement of military assets in support of host nations, the U.S. government (USG), and other partners.

Military capabilities relevant to long-term stability operations include policing, refugee control (i.e., enabling and securing camps with stakeholders), and border protection. This set of operations overlaps with those commonly referred to as peacekeeping operations. During the last 20 years, these operations have generally been the purview of United Nations troops, and U.S. involvement has decreased dramatically. In the future, however, regional strategic interests may increase pressures for U.S. military ground forces to become more involved in these types of security operations in the Asia-Pacific.

Overall, there is much uncertainty about long-range trends, including the rate of development of slow-onset problems in particular countries and localities. Thus, an initial recommendation is for the military to continue contributing to innovative research on indicators and early warning systems as a means to reduce uncertainty over time and guide future operations and investments.

We recommend that the USG promote regional partners to procure the following capabilities, in particular, which would be most relevant to crisis operations in the future. The United States should promote and facilitate partner acquisition of assets and systems required for airlift and sealift to provide inter-

agency support for HADR operations. Capabilities for tactical lift—amphibious ships and other platforms for helicopter operations—are also valuable. The DOD should consider working with regional allies to assemble, equip, and train mobile medical teams and facilities, which are useful not only for HADR but also more broadly. The DOD needs to consider securing naval assets and systems for maritime security and maritime domain awareness to address problems affected by or related to climate change, including illegal fishing, piracy, and maritime territorial and resource disputes. Analysts expect these actions to worsen as climate change affects resource pools and access, especially in nations where governments are unable to attend to the socioeconomic needs of their people or protect critical natural resources. The plague of piracy in the Gulf of Aden and other areas of the African coastline, for example, are partly a response to dwindling fish stocks in those waters, the result of decades of uncontrolled and often illegal fishing, often by foreign fleets.²⁴

Posture

Forward presence through the U.S. military's network of bases, operating locations, regular regional deployments, and access agreements with partners is an important quality that enables quick and early responses in the theater.²⁵ There can be significant challenges to HADR operations if U.S. forces have no presence or routine access to the operational area. Pacific Rebalance, the current U.S. strategy to increase the focus on the Asia-Pacific region, further strengthens that quality and those capabilities.²⁶ In addition to having more forces positioned to respond in a timely manner for HADR operations, military situational awareness and command and control capabilities allow it to lean forward, preparing even as it awaits formal USG assessment of other options and an official request. Naval assets in particular can move into position tentatively, and all Services can have prepositioned supplies staged nearby.

The U.S. military Services are rebalancing in various ways, some of which are relevant to risks related to climate change. The Army's Pacific Pathways, for example, involves the development of small units that will be forward deployed for quick response to humanitarian emergencies or regional threats. The Army has a plan for meeting greater demands for HADR and for working more closely with foreign militaries to build their capabilities.

The demand for U.S. maritime forces is likely to remain high because of security operations in a region where so much valuable economic activity is in the maritime realm. Current tensions over maritime territorial rights are unlikely to go away and may intensify as important resources such as fish stocks dwindle and shift. Naval forces stationed in the region can provide quick response to disaster situations. Rotational deployments around the globe help meet this demand. Furthermore, new concepts for maritime prepositioned ships allow

them to be better able to efficiently off-load particular sets of equipment and supplies, and conduct operations from the sea, rather than while tied to a pier. These capabilities allow for more tailored support to crises.

Posture for missions ashore is related more to prepositioned equipment and basing agreements than it is to maintaining land-based forces in-theater. Maritime capabilities support the movement of land-based forces via strategic airlift or amphibious lift as crises evolve. An important component of the DOD's current strategy in the Asia-Pacific is to strengthen partnerships, which among other things, can lead to agreements that provide sustainable access for forces and supplies to flow to the region.

Implications for International Security Relationships

Several of the region's most industrialized countries—Japan, Australia, South Korea, Singapore, Thailand—are assessed to be most vulnerable to climate change-related risk. These countries, however, are likely to have greater resiliency, and more resources, than many other countries for dealing with the effects of climate change. Part of that resiliency is related to their longstanding traditions of institutionalized, stable democracy (with Thailand lately posing a troubling exception). In contrast, several of the countries assessed as most vulnerable to climate change effects have recent histories of intergroup violence, insurgency, civil war, and terrorism. Bangladesh, Indonesia, Myanmar, Papua New Guinea, and the Philippines seem to face unusually high risks of climate change-related effects combining with societal divisions and weak governing institutions to generate instability and conflict.²⁷

Given that most of these countries have close relationships with powerful regional neighbors (e.g., China and India), the United States is unlikely to be their only or first-choice partner in response to the effects of climate change. Only the Philippines and potentially Papua New Guinea, which could also turn to Australia because of their history and proximity, would be likely to turn principally to the United States. For this reason and considering the growing military capabilities of nations in the region, we assess that the United States will likely play a supporting and potentially coordinating role in future regional security operations with a combination of allies and emerging partners. It is difficult to imagine a security crisis or disaster response in Nepal, Myanmar, or Cambodia, for example, without strong Indian or Chinese involvement.

During the next three decades, several trends are likely to shape the way U.S. allies and partners in the region view and approach security cooperation with the United States and other regional partners. First, most nations in the Asia-Pacific will simultaneously grow larger in population and wealth and become more capable of wielding international influence. Many of them are not current U.S. allies or strategic partners, which will result in a decline in the

weight of current U.S. allies and partners, such as Japan, Australia, the Republic of Korea, Singapore, Thailand, New Zealand, and the Philippines, relative to other “emerging” powers.

This general, regional rise in global importance will center, in large part, on China’s continued emergence as a first-tier global power, a regional giant. Because of China’s rise and the expansion of its influence, other countries in the region are likely to stay motivated to strengthen ties with the United States as a means of balancing that influence. Striking a suitable balance between China, the regional giant, and the United States will continue to be a delicate endeavor, requiring constant tinkering. U.S. allies and strategic partners during the next 30 years are likely to face more nuanced decisions about supporting the United States than they did during the Cold War, when ideological division and superpower competition presented governments with a stark choice that carried fewer economic, educational, social, and domestic engagement complications. The Soviet Union during the Cold War was never a regional hegemon wielding influence across the cultural-economic-political-military spectrum in East Asia as China may become.

Another important trend is the continued strengthening of security cooperation among some U.S. allies and strategic partners. Their security cooperation is likely to be particularly productive and advanced in noncontroversial areas such as HADR, and therefore adaptable to addressing climate change effects, rather than for traditional security challenges involving international conflict. One recent, important example of this trend is the progress in U.S.-Japan-Australia cooperation with South Korea. Furthermore, U.S. allies and strategic partners along with the United States are increasingly likely to work through regional institutional mechanisms on climate change-related cooperation in the future. During the next 30 years, regional institutions such as the Association of Southeast Asian Nations (ASEAN) Defense Ministers Meeting Plus, the ASEAN Regional Forum, the East Asia Summit, and the South Asian Association for Regional Cooperation will likely evolve to become more useful to a wider range of regional cooperation.

The Importance of Emerging Partners

In recent years, emerging nations such as Bangladesh, China, India, Indonesia, Malaysia, Singapore, Thailand, and Vietnam have experienced faster economic growth rates and are modernizing their defense capabilities and doctrines in both air and maritime domains. In several cases, they are increasing their cooperation with the United States and its strategic partners as well as with each other.²⁸

Of these nations, only China, India, and Russia are potential panregional

players, while Indonesia, Malaysia, Vietnam, and Bangladesh are likely to be economically and politically influential in their Southeast and South Asia sub-regions. These emerging partner countries could be especially useful to security cooperation in niche areas or particular cases; for example, Vietnam could be an important partner for the United States in dealing with the effects of climate change in high-risk Cambodia, particularly if the U.S.-China relationship were to complicate or prohibit possibilities of direct U.S. involvement. Future U.S. political and defense leaders should remain cognizant of the critical importance of such partnerships in the region.

For the most part, these emerging partner countries are still on the steepest curve of nation and state building. While each has made tremendous strides in national strength, they also tend to face massive domestic challenges, such as “middle-income traps,” rapid aging, significant environmental erosion, and in some cases, internal separatist movements (e.g., the West Papua movement in Indonesia and the ethnoreligious insurgencies in southern Thailand and southern Philippines). Also, there are significant tensions both between countries in the group (e.g., India-China, Russia-China, India-Bangladesh, Indonesia-Malaysia, and China-Vietnam) and with countries outside the group (e.g., Indonesia-Australia and Russia-Japan). These considerations are reasons for caution in terms of whether they can replace key American allies and strategic partners for security cooperation.

Prospects for Cooperation in HADR

For all countries in the emerging partner grouping, HADR response is a relatively uncontroversial way to develop bilateral ties with regional countries and participate in regional institutions. It is also an area where they can work with the United States without drawing the ire of certain domestic constituencies. In countries such as Indonesia and Malaysia, for example, where domestic currents are critical of the United States for a variety of reasons, there is appreciation for America’s ability and willingness to assist in the case of natural disasters and other humanitarian needs.²⁹

China, India, and perhaps Russia also seek to be seen as responsible powers in the Asia-Pacific and have the capacity to provide HADR in cooperation with and sometimes in lieu of the United States and its allies and strategic partners. Hence, their ability to provide salutary responses to the effects of climate change are likely to be a matter of national pride as well as policy interests. For Indonesia and Malaysia, founding members of ASEAN, the ability of that institution to offer public goods such as HADR is one way of demonstrating the “centrality” of ASEAN to regional affairs and, by extension, enhancing their own influence.

Considering China

Given its rising economic status and military capabilities, China is poised to play an important role in international efforts to address the consequences of climate change in the Asia-Pacific. At present, China's approach to climate change mitigation emphasizes international cooperation, notably with the United States. For instance, enhancing cooperation is a theme of a 2014 report of China's National Reform and Development Commission, which details recent U.S.-China achievements in this area.³⁰

At a military operational level, China and the United States have expanded cooperation in areas that could be relevant to addressing the effects of climate change. Xi Jinping, the current Chinese president, called for a "new type of military-to-military relationship" with the United States as a core component of the broader bilateral relationship.³¹ Specific initiatives include China's first-ever participation in the U.S.-led Rim of the Pacific exercise in 2014, which included Chinese naval involvement in HADR, military medicine training components, and a series of U.S.-China Disaster Management Exchanges.³²

There are several reasons why future Chinese policy could continue to emphasize cooperation with the United States and other regional stakeholders. First, climate change represents an area in which China and the United States can achieve mutual gains, unlike more contentious issues, such as territorial disputes, cyberespionage, or human rights. Second, cooperation allows China to continue to project an image of itself as a "responsible" state, which is useful in countering regional narratives of China as an aggressive rising power. Third, as previously discussed, China faces the prospects of internal economic and social challenges related to climate change. Partnering with more technologically advanced countries, such as the United States, could better enable China to mitigate some of those challenges.

Nevertheless, it is also possible that China will adopt a less cooperative approach to climate change. At a broad strategic level, more intense competitive dynamics in the overall China-U.S. relationship could undermine cooperation even in areas of relative agreement, such as policies to address climate change. A lack of mutual trust between Beijing and Washington could also complicate cooperation.³³ In addition, China may decide to unilaterally pursue novel ways to reduce the risks of climate change, such as solar radiation management, which have not been endorsed by the United States or the broader international community.³⁴

Black swan events in China or at a regional level could also lead to less cooperative, more dangerous outcomes. Such unforeseen circumstances could include a transition from Chinese Communist Party rule to a new democratic or authoritarian regime that is less capable of, or interested in, addressing the effects of climate change; an economic setback that could refocus the gov-

ernment's attention on short-term challenges rather than on the longer-term problems associated with climate change; or an armed conflict between China and one of its neighbors, such as Japan or the Philippines, which may involve the United States and could derail ongoing environmental or nontraditional security initiatives. Still, assuming the absence of such a disruptive event, we assess that China has numerous reasons and sufficient capacity to increasingly develop and offer its capabilities for responding to HADR within the region.

Policy Recommendations

The U.S. military coordinates with the State Department, USAID, and other USG agencies in efforts to work with partner nations to improve resilience of countries vulnerable to adverse impacts from climate change. Once crises have occurred, the military can help deal with complex humanitarian emergencies that involve HADR combined with state instability or conflict situations.

In our assessment, climate change-related effects are not likely to impact warfighting capabilities, operations, or plans for major combat operations during the next 30 years. Moreover, they are likely to significantly increase the demand for, and frequency of, theater security cooperation and humanitarian assistance and disaster relief missions. Rapid-onset events, such as storms and floods, are likely to occur more frequently, be more intense, and happen in more places than in past decades. Of higher concern, because their effects are more pernicious, widespread, and harder to manage, are slow-onset problems such as water scarcity, agricultural stress, and dwindling fish stocks. These effects of environmental change on human systems and the follow-on responses they create (i.e., effects from human responses) could contribute to instability and raise risks of regional conflict, especially in crisis-prone areas, such as along the Bangladesh-Indian border and across major transnational river systems.

Theater Security Cooperation

Preparing for and addressing these effects calls for sustained DOD measures to help prevent crises through scientific and technical cooperation, mitigate damage by improving regional preparedness and resilience, and strengthen regional capabilities for disaster response. We recommend that the DOD expand its TSC activities, which are essential for improving regional resilience and cooperation, improving goodwill and access for U.S. forces, and promoting stability and security across the region.

We recommend that the DOD leadership crafts its TSC efforts in ways that leverage the vitality of multilateral regional institutions including the ASEAN Defense Ministers' Meeting-Plus and the ASEAN Regional Forum, and that the DOD encourage greater investment and cooperation from key emerging powers, such as India, Indonesia, Thailand, and Vietnam. Within 30 years, these

and other Asia-Pacific nations are likely to have significant regional influence and operational capabilities. Their influence is likely to be strong in subregions that are expected to be severely affected by the effects of climate change, such as the India-Bangladesh-Myanmar coastal areas and the stretch of islands from Papua New Guinea to the Philippines. To promote regional resilience, we recommend that the DOD continues to encourage multilateral dialogue, joint exercises, and cooperation on HADR operations through bilateral, trilateral, and multilateral agreements and organizations. We recommend that the DOD and wider USG security cooperation efforts include dialogue with, coordination with, and inclusion of China. Climate change-related security problems, especially the need for capacity building and adaptation to meet these security problems, offer useful framework for collaboration not only with China but also with NGOs and private sector actors.

Humanitarian Assistance and Disaster Relief

Humanitarian assistance and disaster relief operations are already an important component of USPACOM's workload. In the future, we expect it to become a greater portion of actual operations, and it may well take on a more strategic significance in support of either regional stability and security institutions or new alliances and coalitions. Even with more intense and frequent storms, floods, droughts, and other weather events, USPACOM's resources and capabilities for supporting HADR missions are likely to be sufficient. We anticipate that the DOD, however, will likely be required to support and, at times, lead responses that are particularly complex and dangerous to key partners. A regional future that includes dwindling resources, water, and food within a context of high inequality as well as ideological and international tensions presents scenarios where one or more complex HADR operations (i.e., an HADR operation during an armed conflict or insurgency operations) are required. Such operations could last for months or longer. If so, concurrent HADR operations would likely be required. Adding further difficulty, these complex and potentially multiple operations would have to be conducted without compromising USPACOM's capabilities to support its other high priority missions.

Better Planning and Monitoring

In the coming decades, DOD planners should be conservative in their risk estimates and consider crises to be likely. In our view, DOD planners and their government partners should prepare for the possibility of more than one crisis, and resulting conflict, occurring at the same time within the Asia-Pacific. The DOD should continue to promote the development of analytical methods to monitor country and regional risk levels of short-term (0–3 years) and mid-term (3–5 years) environmental and climate change-related effects.

The risks associated with future climate change-related effects in the Asia-Pacific in the next 30 years do not appear to call for significant changes in force structure or assets. USPACOM has enough resources and assets for these operations as well as impressive logistical and operational flexibility. Furthermore, various regional USPACOM partners, including more than just the national security forces but also corporations, multinational organizations, and NGOs, are improving their own HADR preparedness and capabilities. Steady improvement of regional security cooperation will improve HADR outcomes.

Promising regional trends notwithstanding, the USG has not called on the DOD to be as responsive to foreign disasters as it could, for example, at the rate seen during the Cold War. Also, there is significant uncertainty about the future speed and intensity of the effects of climate change.³⁵ Since political and social factors in the region are variable, and scientific knowledge of the effects of climate change is improving every year, we recommend continued, careful monitoring of projected climate change-related effects as well as trends in human collective responses to those effects and an openness to future reevaluation as expectations and risk levels change.

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